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Multiphase oxygen electrodes for solid oxide electrolysis cells

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Solid oxide electrolysis has the potential to become the most efficient way to convert electrical into chemical energy. Solid oxide electrolysis cells (SOEC) are thus an attractive solution for converting the occasional surplus amount of electricity produced by renewable energy sources to hydrogen or syngas. This promising technology requires further maturation to become economically competitive. Among other problems, the sluggish reaction at the oxygen electrode limits maximum fuel production rate, which directly affects overall process efficiency. Recent studies published by several groups highlight the importance of dissimilar interfaces and surface chemistry in promoting oxygen electrode reaction rate, opening a new route to enhance the electrode performance. Particularly, perovskite (113)/Ruddlesden-Popper (214) interface has been reported as highly beneficial for strontium doped lanthanum cobaltite (LSC) electrodes.[1–3]

The aim of this study is to investigate the potential of 113/214 interface to improve cobalt-free electrodes such as strontium doped lanthanum ferrite (LSF). The performance of LSF_{113}/LSF_{214} couples is assessed by electrical conductivity relaxation (ECR) of geometrically well-defined electrodes, as well as by electrochemical impedance spectroscopy (EIS) of thin film electrodes prepared by PLD. The surface of the model electrodes is deliberately modified in a controlled manner by addition of secondary phases and examined by SEM and surface-sensitive characterization techniques.

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